REVIEW

The relation between child death and child maltreatment

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The death of a child is a sentinel event in a community, and a defining marker of a society's policies of safety and health. Child death as a result of abuse and neglect is a tragic outcome that occurs in all nations of the world. The true incidence of fatal child abuse and neglect is unknown. The most accurate incidence data of such deaths have been obtained from countries where multi-agency death review teams analyse the causes of child fatalities, as is done in the United States and Australia.

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Obtaining accurate identification and details of child maltreatment cases is a challenge for many reasons. For one, at its essence, child maltreatment is a deceptive and easily disguised entity. Next, suboptimal investigations are done in many jurisdictions. Poor collaboration between police, hospitals, and child welfare agencies is common, leading to incomplete information. There is also an absence of consensus with regard to definitions of child maltreatment. Definitions of ''child homicide'', ''abuse'', and ''neglect'' vary markedly, depending on the agency, the state or the nation involved. Infants killed shortly after birth can be ''hidden'' and not reported in vital statistics if the birth was unattended or occurred out of hospital. Finally, child deaths resulting from neglect or emotional abuse are seldom identified as child maltreatment deaths.

The World Health Organisation's International Classification of Diseases coding system, used to define cause of death on death certificates, allows for significant under-ascertainment of the number of child fatalities caused by child maltreatment.[1] In the United States, existing numbers for child fatalities have been shown to grossly underestimate the actual number of children dying from maltreatment.[2 3] Herman-Giddens *et al* reported in one study how the vital records system of the State of North Carolina under-recorded the coding of child homicide cases due to abuse by almost 60%.[2] In Colorado, 50% of maltreatment deaths were not coded on death certificates.[1] Since ICD coding is the international standard diagnostic classification, other states and nations probably have similar rates of under-representation of child mortality from maltreatment.

MORTALITY RATES FROM MALTREATMENT

Data have been gathered from many countries on child maltreatment deaths, although there are concerns that other countries' data may also under-ascertain child maltreatment deaths. In 2003, UNICEF published a report on child maltreatment deaths in industrialised countries.[4] The report states that 3500 children under age 15 die each year from abuse or neglect in 27 rich countries. At one end of the scale, Spain, Greece, Italy and Ireland have the lowest rates of maltreatment deaths, 0.1 to 0.2 deaths for 100 000 children. At the other end, the United States and Mexico have the highest rates, 2.2 deaths per 100 000 children. The report also found that countries with exceptionally high rates of child maltreatment deaths also have high rates of death from adult homicides.

The World Health Organisation estimates 57 000 children die yearly from fatal maltreatment.[5] The rate of death in low to middle income countries is thought to be two to three times higher that in high income countries. The highest homicide rates for children under 5 years of age occur in Africa, where the rate is estimated as 17.9 deaths per 100 000 boys and 12.7 per 100 000 girls.

NEONATICIDE

Neonaticide refers to killing of an infant shortly after birth, usually on the first day of life. The perpetrator is most often the mother of the child.[6] The US Centers for Disease Control and Prevention found that the risk of being a victim of homicide is 10 times greater on the first day of life than at any other time during the life cycle.[7]

Studies of perpetrators of neonaticide have identified common characteristics in the women.[8 9] They are often psychotic or dissociative. They often deny the existence of their pregnancy and describe not experiencing pain during delivery. Child physical and sexual abuse is prominent in their histories. A high percentage of the victims are not born in a hospital or healthcare facility.[7 10]

In some cultures, girls are more likely to be killed at birth or selectively aborted because of their perceived decreased societal value, leading to marked imbalance in the male:female ratio.[11 12]

In the USA, 46 of 50 states have so called ''safe haven laws'' that allow mothers to take unwanted newborn babies to hospitals or fire stations and leave them there without having any questions asked or without having to leave identifying information. It is estimated that up to 85 babies per year could be saved if mothers took advantage of this opportunity.[6]

Abbreviations: SIDS, sudden infant death syndrome; SUDI, sudden unexpected death in infancy

INFANTICIDE

In the USA, infanticide is usually considered to be the murder of a child aged 1 day to 1 year.[13] Intentional injury is the leading cause of injury death in the first year of life.[14] Available child homicide figures are likely to be lower than the actual figures as some deaths may not have been recognised as homicides, thus leading to misclassification of cause of death as either undetermined, accidental, or natural (sudden infant death syndrome instead of intentional suffocation).[1] In England and Wales, infanticide has a more limited legal definition. The Infanticide Act 1938 defines it as a death of a child under age 12 months whose mother causes their death by a wilful act or commission, but whose mother's balance of mind is disturbed by either not having recovered from child birth or experiencing effects of lactation.

Certain maternal characteristics have been identified that are associated with homicide in the first year of life, including young maternal age, low level of education, unmarried, and no prenatal care.[10 15] Infant characteristics include low birth weight, low gestational age, male sex, and low Apgar scores.[14 15] One fourth of all infant homicides occur by 2 months of age, and one half by 4 months of age.[10] While mothers are more likely to kill newborns, fathers and stepfathers are more likely to kill older infants.[10]

CHILD ABUSE DEATHS IN GENERAL

In the United States, homicide is a common cause of death. Table 1 lists the ranking of homicide in causes of death by age group.[16]

In general, male children of minority race are much more frequently victims of fatal abuse.[11] When looking at the presenting history, one study found that falling was the most commonly given explanation for the child's symptoms. Second most common was that the child was found unresponsive.[11] According to a study done by the US Air Force, 59% of child abuse deaths were preceded by a family argument where the adults argued about an impending break-up of their relationship.[17]

Family configuration has been significantly linked to risk of child maltreatment deaths. Children living in a household with an unrelated adult were 27 times more likely to die of inflicted injury than children living with one or two biological parents. Most of the deaths occurred when unrelated males and ''mother's boyfriends'' lived in the home.[18]

Head trauma is the most common cause of fatal child abuse.[19 20] Comparisons of children with inflicted and non-inflicted head trauma reveal that patients with inflicted injuries are younger and have a higher average injury severity level and overall mortality rate than do patients with unintentional head trauma.[21] Making the diagnosis of abusive head trauma is often difficult. A child may present with no external evidence of trauma, particularly if the abusive event did not involve impact. Victims have various presenting signs and symptoms ranging from irritability and decreased responsiveness to convulsions and death. A study examining 173 abused infants found that nearly one third of infants with inflicted head injury were misdiagnosed on their initial presentation for medical care.[22]

Table 1 Ranking of homicide as a cause of death by age group in the USA, 2002[16]

Age range (y)	Ranking of homicide as cause of death
1–4	Third
5–9	Fourth
10–14	Fifth
15–18	Second

OTHER FORMS OF MALTREATMENT DEATHS

In the USA in 2002, 38% of child maltreatment deaths were caused by child neglect.[23] This involves a wide range of circumstances, including starvation, neglecting to provide potentially life-saving medical care, providing inappropriate supervision of dangerous activities, and allowing a child to die from exposure to heat, cold, or inadequately safeguarded poisons. Asser and Swan documented 127 deaths of children over a 20 year period whose parents relied on faith-healing instead of getting their children medical care for serious illnesses that were potentially treatable.[24] The number of child deaths resulting from neglect is most likely much higher than recorded because of officials' reluctance to blame a grieving parent for an ''accident''.[3]

Another form of child maltreatment that can cause child death occurs when carers induce or fabricate illness in their children.[25 26] These purposeful acts can lead to harmful intervention by medical practitioners attempting to effectively treat unexplained or undiagnosable illness, but more commonly death is caused by the parent suffocating or poisoning the child.[27 28] Mortality rates are quoted to range from 9% to 31%.[26 29] Since these numbers were derived from reported cases in the literature (Rosenberg) and from one clinician's experience (Alexander), they are not epidemiologically valid estimates and suffer from ''the availability heuristic''. That is, reported cases are likely to be more dramatic and serious than those that do not make it into the medical literature.[30]

Many other deaths that are the ''fallout'' from child maltreatment are not generally counted as ''child maltreatment deaths''. Examples include suicides by children who have experienced either sexual abuse or neglect, leading to depression.[31] Other examples are deaths from drug or alcohol overdoses and deaths resulting from risk taking behaviours, including sexual risk taking that can lead to HIV infection. Risk taking and substance abuse are increased in physical and sexual abuse survivors.[32–35]

One study has shown that children reported to social service agencies for suspected child abuse or neglect had an excessively high death rate from all causes in the years that followed.[36] Children listed on a state's child abuse registry were almost three times more likely to die before their 18th birthday compared to children not found on the registry (9.1 compared with 3.1 deaths/10 000 years of risk). The increased death risk was highest for children who had experienced physical abuse, but the difference was striking and statistically significant for neglected and sexually abused children as well. Children under 1 year of age at the time of their abuse had a subsequent death rate of 20.9/10 000 years of risk. This and other studies support the intuitive notion that abused and neglected children are at increased risk for adversity throughout their childhood.

SUDDEN UNEXPECTED DEATHS IN INFANCY

Sudden unexpected death in infancy (SUDI) can be caused by a myriad of medical conditions. SUDI is usually divided into two categories: deaths from sudden infant death syndrome (SIDS), and everything else.[37] In the USA, SIDS is currently defined as ''the sudden unexpected death of an infant less than 1 year of age with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation including performance of a complete autopsy and review of the circumstances of death and a clinical history''.[38] Other definitions and subcategories have been proposed.[39] Essentially it is a diagnosis of exclusion. SIDS is not likely to be a specific disease with a

Table 2 Recently published protocols for the autopsy and investigation of sudden unexpected infant deaths

Organisation	Date	Authors	Characteristics of protocol
SIDS Global Strategy Task Force	1996	Krous[65] Krous and Byard[66]	The protocol includes descriptions and data collection instruments for the investigation of the scene of an unexpected infant death and for the actual postmortem examination procedures and tests recommended
US Centers for Disease Control and Prevention	1996	Centers for Disease Control and Prevention[67]	The basis of this protocol is a data collection instrument to be used by first responders at the scene of an unexpected infant death
Working Group of the Royal College of Pathologists and the Royal College of Paediatrics and Child Health	2004	Sudden unexpected death in infancy[64]	This document is a comprehensive inter-agency directive describing the recommended response to unexpected infant deaths, including scene investigations, postmortem examination protocols, police investigations, medical response, and parent support

single cause, but is more likely a result of a variety of factors including the infant's environment, situation, and genetic and physiological makeup.

Causes of SUDI other than SIDS include cardiovascular diseases, respiratory diseases, haematological disorders, central nervous system diseases, gastrointestinal diseases, genitourinary conditions, endocrine disorders, metabolic diseases, infectious diseases, genetic diseases, accidents, and homicide.[40] The problem, then, is correctly determining which infants died of natural causes, which died of accidents, which succumbed to SIDS, and which were murdered.

The rate of SIDS has declined dramatically in the USA and Great Britain in the past decade since the institution of safe sleeping practices for babies has been promoted. This has led to speculation that a higher *proportion* of sudden unexpected deaths in infants is due to homicide.[41]

The occurrence of more than one SIDS death in a family has led to increased suspicion of covert homicide. The idea was proposed by two distinguished American pathologists, Drs DJ and VJM DiMaio, who opined in their 1989 textbook, *Forensic Pathology*, ''It is the general policy of the authors to ascribe the first death in a family presenting as SIDS to SIDS. The second death by the same mother is labeled undermined, and a more intensive investigation of the circumstances surrounding the death is conducted. … A third such death in the family is felt by the authors to be homicide until proven otherwise''.[42] While the risk of repeated cases of SIDS in the same family is debated, Byard and Krous point out that the same genetic and risk factors that led to the first SIDS death will persist in families, making it more likely that a second death might occur in the same family.[40] So although repeat SIDS deaths are quite rare, they may not occur randomly. Thus, DiMaio's law is not a reliable ''rule of thumb'', and each case of multiple infant deaths in the same family should be evaluated carefully and objectively.

Reports of infanticide by intentional suffocation have been well publicised and acknowledged.[43 44] Such reports have forced both the public and the professional community to be aware of the critical importance of distinguishing SIDS from fatal child abuse. The problem is, however, that suffocation of an infant with a plastic bag or a soft item such as a pillow can be indistinguishable from SIDS on postmortem examination. This leaves investigators and medical examiners in a terrible dilemma, particularly when more than one infant dies unexpectedly in a family. On the one hand, if a crime goes undetected, innocent children born into the same family might be at risk of suffering and death. On the other hand, if they accuse innocent parents of killing their children when the children have died of natural causes, they cause the parents pain and grief. Innocent parents might be jailed for crimes they did not commit.

Even if the case is not adjudicated, parents feel accused because of the investigation process. This is made worse if the investigations are done poorly or incompletely, thereby overlooking important information that could lead to an accurate diagnosis of the cause of the children's deaths.

The best procedure is to have a complete, professional, dispassionate, unbiased investigation. When this occurs, parents are protected. If there are inherited conditions in their families, medical precautions can be taken to test and protect future and existing children. If unsafe sleeping practices are identified, parents can be educated to protect their future children from harm. If a protocol for child death investigation is in place, grieving parents can be reassured that they are not being singled out or blamed, but instead, that a thorough investigation is standard practice, done in all cases of unexpected infant death.

Since most cases of suffocation are undistinguishable from SIDS, physicians and investigators have to accept a certain level of uncertainty when approaching cases of unexpected infant death. The standard of ''beyond a reasonable doubt'' in the courts makes it unwise to adjudicate a case without specific evidence of parental wrongdoing.

THE SPECIAL CASE OF ACCIDENTAL INFANT SUFFOCATION AND ASPHYXIA

Recent studies have documented an alarming increased risk of sudden unexpected death when young infants sleep in the same beds with their parents, or when they sleep alone in adult beds or on other soft furniture such as couches and arm chairs.[45–50] This may be due in part to the use of investigative protocols that has led to an increase of the recognition of unsafe sleep environments experienced by infants who die suddenly.[51]

Infant death in an unsafe sleeping environment can by caused in many different ways.[52] The child can die from mechanical asphyxiation if a sleeping adult rolls on top of the child and occludes the airway or mechanically constricts the chest. Asphyxia can also occur if the child's head is wedged between the mattress and the bed frame or between a sofa cushion and other hard surface. Soft mesh-sided playpens also have been shown to cause an infant's head to be pushed by the stretchy mesh into the side of a mattress or pad, causing nasal occlusion.[53] The child's face can become pressed into a soft mattress, causing rebreathing of carbon dioxide. In water beds, the face can become trapped in the soft surface. The child's neck can become pressed against a frame or railing, causing compression of the neck vessels. The large vessels of the infant neck can become occluded when as little as 2 kg of pressure is exerted on the neck.

Others opine that co-sleeping increases infants' arousal, thereby decreasing the risk of SIDS.[54] This remains a

hypothesis. Certainly, co-sleeping has been shown to encourage breast feeding. Co-sleeping infants breast feed more frequently and for longer periods of time than infants who do not sleep with their mothers.[55]

A large case-control study in England found a markedly increased risk of sudden unexpected infant death in infants who shared a bed with their parents, and an even higher risk if the infant shared a sofa with a sleeping adult.[56] The English study also found that young infants who slept in a room by themselves were at increase risk of sudden unexpected death compared to infants who slept in a separate structure from their parents but in the same room.

Blair *et al* found the increased risk of sudden unexpected death was insignificant if the adults did not smoke or consume alcohol.[56] Two other recent studies, however, concluded that the risk of death to very young infants remained increased in co-sleepers, even if alcohol or tobacco use was not present.[57 58] Both the American Academy of Pediatrics and the Canadian Paediatric Society have recently recommended that the safest sleep environment for young infants is to have the infant sleep in their own crib proximate to their parents, in the same room with their parents.[59 60] The UK Department of Health recommends that parents and infants should not bedshare if the parents smoke or drink.[61]

In most cases of sudden unexpected infant death in an unsafe sleeping environment, the coroner or medical examiner who decides on the manner of death of the infant (accident, homicide, or unknown) uses some degree of judgement and subjectivity in making that determination. Whether or not asphyxia or suffocation are diagnosed will depend on the individual practitioner's opinion and how he or she weighs the evidence from the scene investigation. Postmortem examination findings are usually undistinguishable between cases of SIDS and cases of asphyxia from unsafe sleeping.[62]

PROTOCOLS FOR ADEQUATE INVESTIGATION OF SUDDEN UNEXPECTED INFANT DEATH

Several excellent documents outlining recommended procedures for the investigation and postmortem examination of sudden unexpected infant deaths have resulted from the work of multidisciplinary panels of experts in different countries. The adoption of these procedures would most certainly decrease the number of misattributed infant deaths. As stated eloquently by Byard and Krous in a recent review article, ''Without question the percentage of misdiagnosed cases is inversely proportional to the extent of the case investigations''.[40] A list of recently published protocols is presented in table 2.

CHILD DEATH REVIEW PROGRAMMES

Since the cause of child fatalities is frequently misidentified, a more comprehensive, community based mechanism has emerged to fill the gap. These programmes are referred to as ''child death review teams (CDRT) or child fatality review teams''. By definition, they are multidisciplinary, multiagency groups that review many different types of child fatalities.[63] No established protocols or standards currently exist for child death review teams. Each individual jurisdiction tailors the review process to its own needs and capabilities. The most important aspect of CDRT is to have people from the various disciplines involved with child health and safety participate and share knowledge and information.

One third of the CDRT in the USA function without enabling legislation. CDRT can watch for fatal child abuse cases that are misclassified or misdiagnosed as deaths due to natural causes or unintentional injury. They also find deaths due to unrecognised neglect, and document trends in preventable deaths.

Child death review teams are active in Canada, Australia, and in 48 states in the United States. In Great Britain CDRT will be created in every local authority under new government plans.[64]

SUMMARY

The proper ascertainment of a child's death as due to maltreatment takes careful, objective assessment by multiple professionals. Excellent professional work by physicians, law enforcement officers, attorneys, and the judiciary will assure the rights of children and families are respected and justice is served. This requires governments to provide adequate resources to educate professionals and to equip them with the tools and support they need to diagnose and investigate cases properly.

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